The Northwestern Hawaiian Ridge: Geochemical variations over 40 Myr

LAUREN HARRISON[1], DOMINIQUE WEIS[1], JONATHAN TREE[2] AND MICHAEL O. GARCIA[2]

[1]Pacific Center for Isotopic and Geochemical Research, University of British Columbia, Vancouver, Canada
[2]Department of Geology and Geophysics, University of Hawai'i, Honolulu, HI, USA

The Northwestern Hawaiian Ridge (NHR) is the ~2800 kilometer long track of seamounts, small islands, and atolls erupted from the Hawaiian mantle plume between the Hawaiian Islands and the bend in the Hawaiian-Emperor hotspot track spanning roughly 40 million years. Geochemically this region is largely unstudied, which is surprising considering the opportunity to examine the long-term evolution of a mantle plume over a period of time where significant changes have taken place in: tectonics (the bend in the Emperor-Hawaiian seamount chain [1]); geochemistry (the emergence of the Loa geochemical trend somewhere along the Hawaiian Ridge [2]); and plume flux (a 300% increase over the last 40 million years [3]).

We analyzed 21 samples of shield (7), post-shield (10) and rejuvenated lavas (4) from 9 different NHR volcanoes for major and trace element concentrations and Pb-Hf-Nd-Sr isotopic compositions. For shield lavas, $^{206}Pb/^{204}Pb$ ranges from 17.874 for Daikakuji seamount to 18.551 at Gardner. The Pb isotopic characteristics of Daikakuji shield lavas are comparable to those of Lanai, a Loa-trend volcano. Daikakuji also has higher SiO_2 (~51 wt %), Sr/Nb (22.4-30.3), La/Nb (1.0-1.1) as is typical of Loa-trend volcanoes, but with Zr/Nb (10.9-12.5) within the range of Mauna Kea values (10-13). Conversely, Gardner volcano has $^{87}Sr/^{86}Sr$ ~0.70351, ε_{Nd} ~7.7, ε_{Hf} ~13.6, and a Zr/Nb less than 14.

The range in $^{206}Pb/^{204}Pb$ of post-shield lavas is from 17.830 on Daikakuji to 18.554 for Academician Berg and all, excepting Daikakuji, plot within the Kea field in a Pb-Pb diagram, comparable to recent (<5 Ma) post-shield lavas within the Hawaiian Islands (except Mahukona).

In this study, Pb-Hf-Nd-Sr isotopes and elemental concentrations suggest the presence of Loa enriched signature as early as ~45 Ma at Daikakuji seamount [4]. We have obtained ~50 samples of NHR volcanoes whose future analysis may unearth some additional insights into the origin of Loa-type volcanism and Hawaiian mantle plume dynamics over extended periods of time.

[1] Sharpe and Clague (2006) *Science*, **313**, 1281-1284. [2] Garcia *et al* (in press) GSA Special Volume on Large Igneous Provinces. [3] Vidal and Bonneville (2004) *J. Geophys. Res.* **109**, B03104. [4] O'Connor *et al* (2013) *Geochem.Geophys. Geosyst.* **14** (10), 4564-4584.